



NTSB National Transportation Safety Board

**Reducing Risk
While
Improving
Productivity:**

Presentation to:

American Gas Association

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Key Lessons Learned

The Contrast

- Conventional Wisdom:

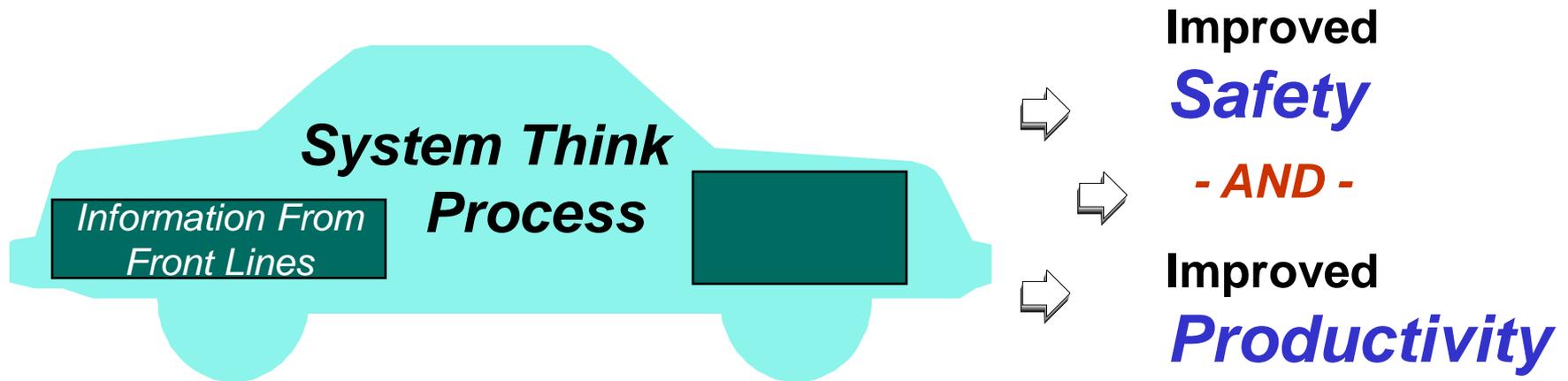
Improvements that reduce risk usually
also reduce productivity

- Lesson Learned from Proactive Aviation Safety Information Programs:

Risk can be reduced in a way that also results in
immediate productivity improvements



Process Plus Fuel Creates A Win-Win



Outline

- **The Context**
- **Importance of “System Think”**
- **Importance of Better Information**
- **Safety Benefits**
- **Productivity Benefits**
- **Aviation Successes and Failures**
- **Roles of Leadership and Regulator**



The Context: Increasing Complexity

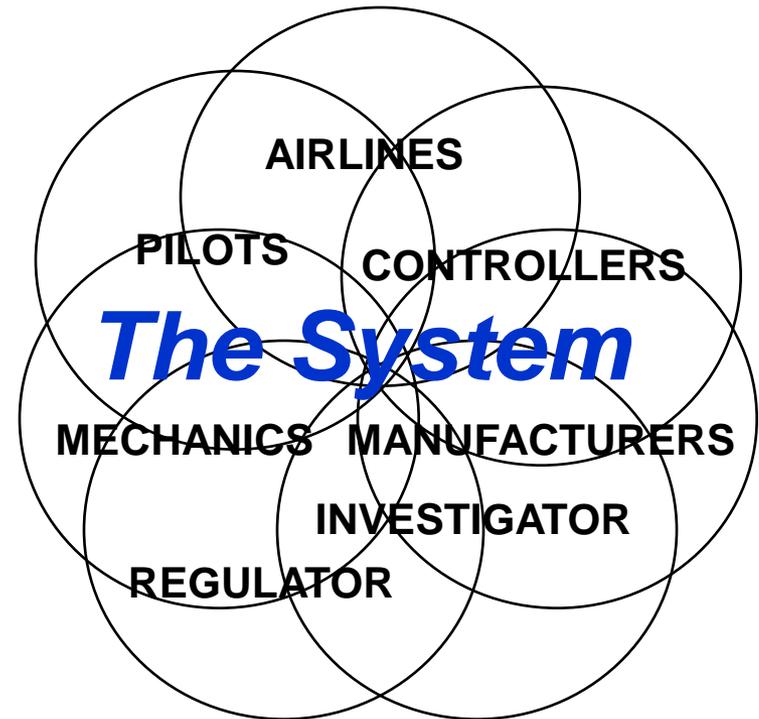
- **More System**

 - *Interdependencies*

 - Large, complex, interactive system
 - Often tightly coupled
 - Hi-tech components
 - Continuous innovation
 - Ongoing evolution

- **Safety Issues Are More Likely to Involve**

 - *Interactions Between Parts of the System*



Effects of Increasing Complexity:

More “Human Error” Because

- **System More Likely to be Error Prone**
- **Operators More Likely to Encounter Unanticipated Situations**
- **Operators More Likely to Encounter Situations in Which “By the Book” May Not Be Optimal (“workarounds”)**



The Result:

Front-Line Staff Who Are

- Highly Trained
- Competent
- Experienced,
- Trying to Do the Right Thing, and
- Proud of Doing It Well

... Yet They Still Commit

**Inadvertent
Human Errors**



When Things Go Wrong

How It Is Now . . .

You are highly trained

and

If you did as trained, you
would not make mistakes

so

You weren't careful
enough

so

You should be **PUNISHED!**

How It Should Be . . .

You are human

and

Humans make mistakes

so

Let's *also* explore why the
system allowed, or failed to
accommodate, your mistake

and

Let's **IMPROVE THE SYSTEM!**



Fix the Person or the System?

Is the **Person**
Clumsy?

Or Is the
Problem . . .

The *Step???*



Enhance Understanding of Person/System Interactions By:

- Collecting,**
- Analyzing, and**
- Sharing**

Information



Objectives:

Make the System

*(a) Less
Error Prone*

and

*(b) More
Error Tolerant*

The Health Care Industry

To Err Is Human:

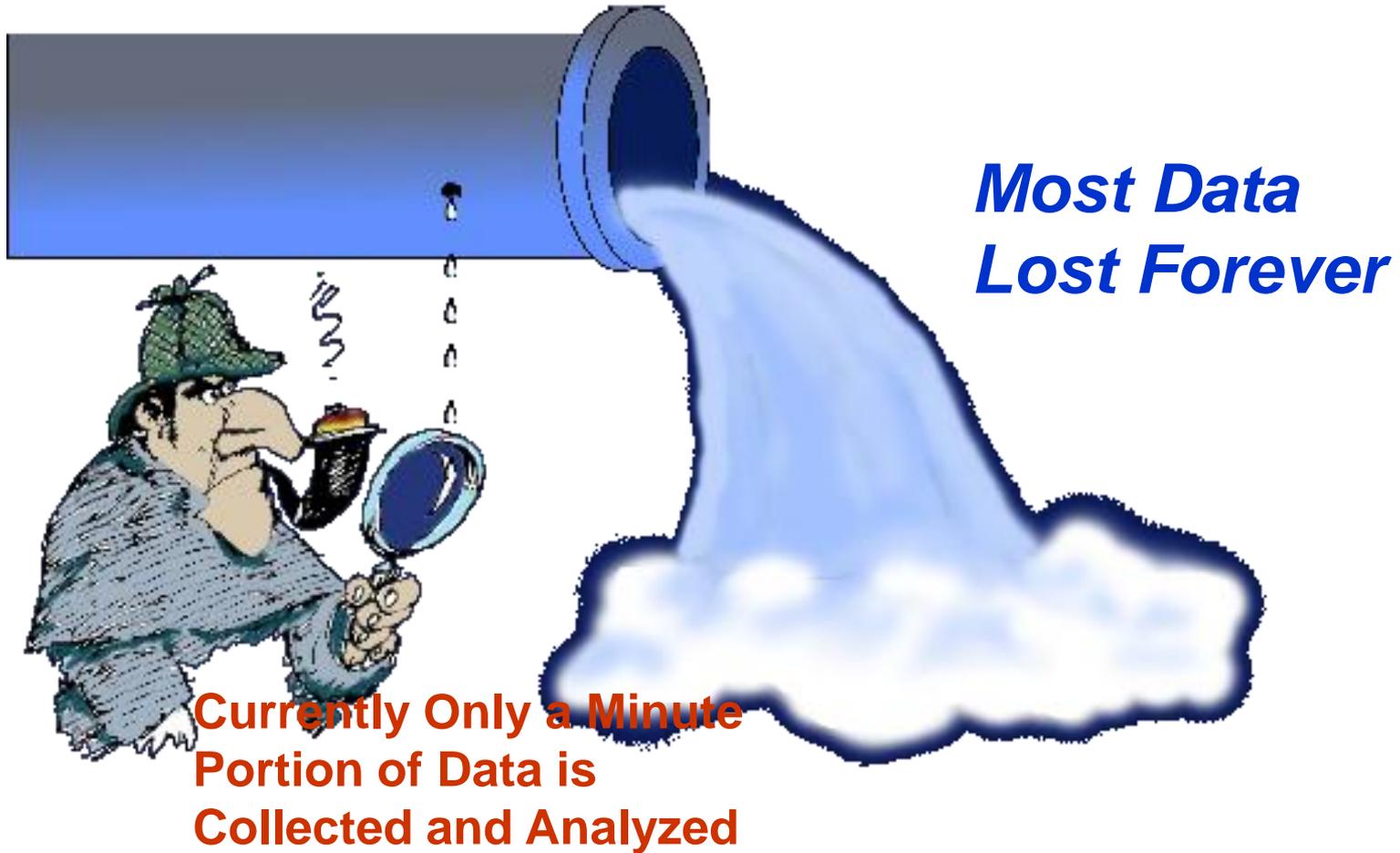
Building a Safer Health System

“The focus must shift from blaming individuals for past errors to a focus on preventing future errors by designing safety into the system.”

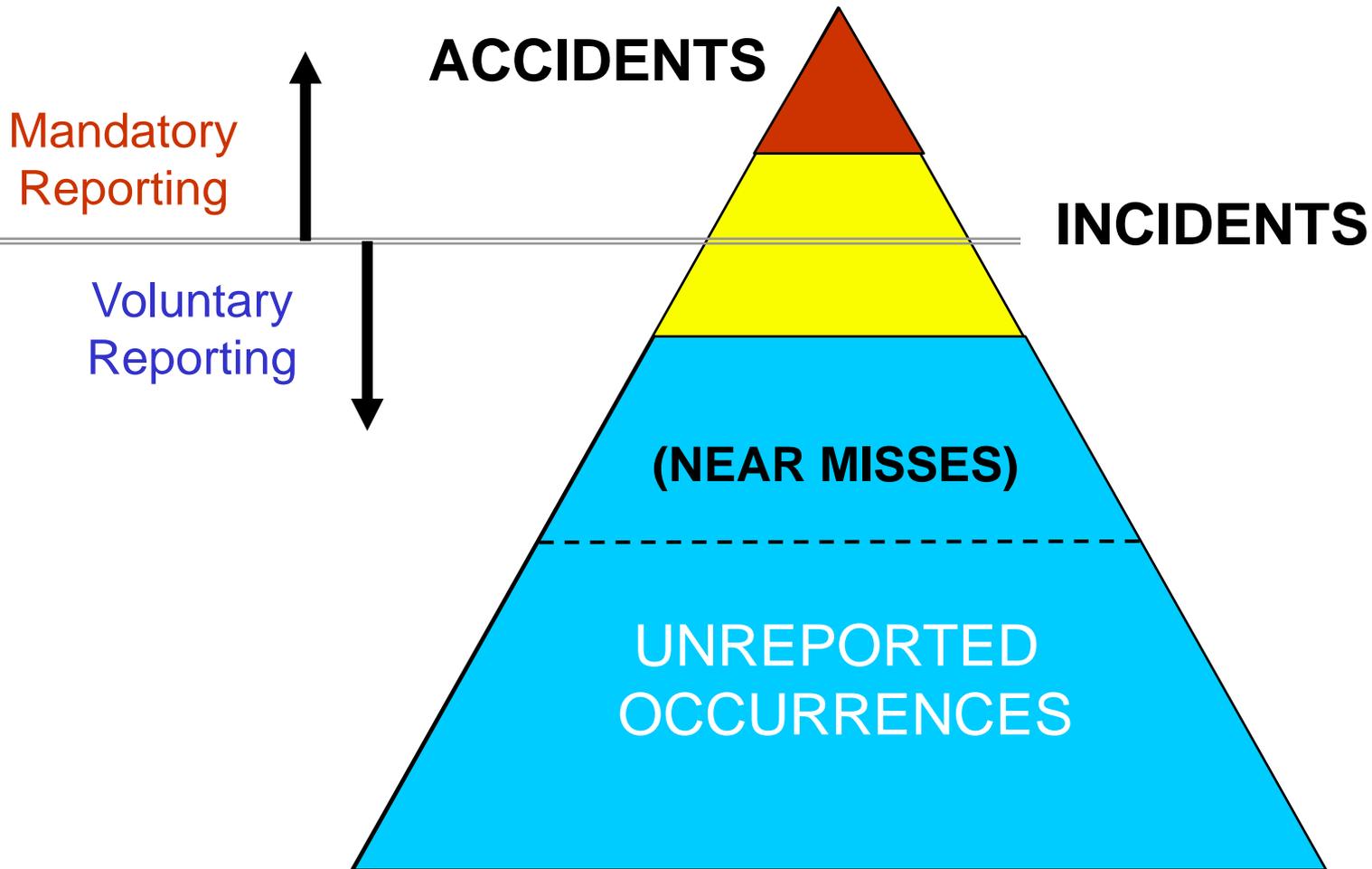
Institute of Medicine, Committee on Quality of Health Care in America, 1999



Current System Data Flow



Heinrich Pyramid



Major Source of Information: Hands-On “Front-Line” Employees

“We Knew About That Problem”

***(and we knew it might hurt
someone sooner or later)***



Legal Concerns That Discourage Collection, Analysis, and Sharing

- **Public Disclosure**
- **Job Sanctions and/or Enforcement**
- **Criminal Sanctions**
- **Civil Litigation**



Typical “Cultural” Barrier



CEO

“Safety First”

**Middle
Management**



“Production First”

**Front-Line
Employees**



**“Please the Boss First...
THEN Consider Safety?”**

Next Challenge



Legal/Cultural Issues

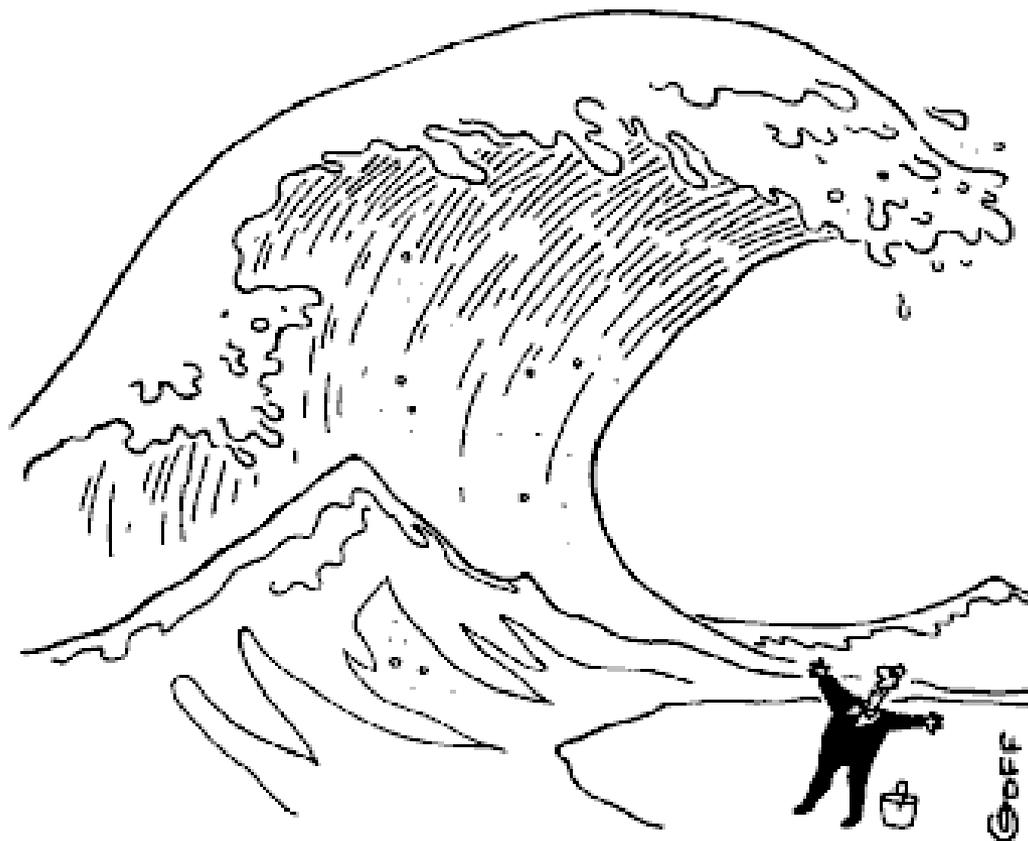
Improved Analytical Tools

As we begin to get over the first hurdle, we must start working on the next one . . .



Information Overload

© 1996 Ted Goff



"EUREKA! MORE INFORMATION!"

From Data to Information

Tools and processes to convert large quantities of data into useful information

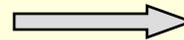
Data Sources

Info from front line staff and other sources



Analysts

USEFUL



INFORMATION

Smart Decisions

- Identify issues
- **PRIORITIZE!!!**
- Develop solutions
- Evaluate interventions



Tools

Processes



Aviation Success Story

65% Decrease in Fatal Accident Rate,
1997 - 2007

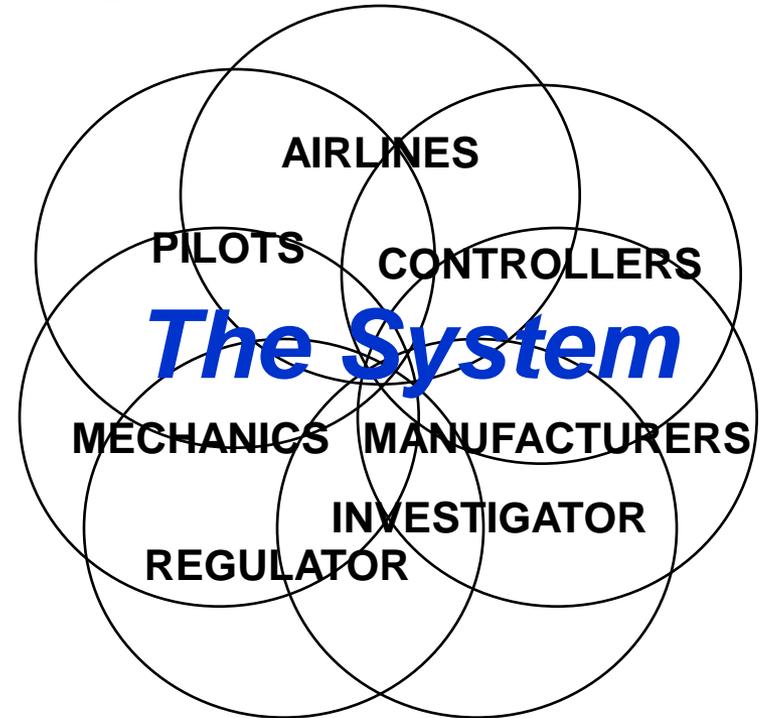
largely because of
System Think

fueled by
***Proactive Safety
Information Programs***

P.S. Aviation was already considered **VERY SAFE** in 1997!!

Aviation “System Think” Success

- Engage All Participants In Identifying Problems and Developing and Evaluating Remedies
- Airlines
- Manufacturers
 - *With the systemwide effort*
 - *With their own end users*
- Air Traffic Organizations
- Labor
 - *Pilots*
 - *Mechanics*
 - *Air traffic controllers*
- Regulator(s) [\[Query: Investigator\(s\)?\]](#)



Major Paradigm Shift

- **Old: The regulator identifies a problem, develops solutions**
 - Industry skeptical of regulator’s understanding of the problem
 - Industry fights regulator’s solution and/or implements it begrudgingly

- **New: Collaborative “System Think”**
 - Industry involved in indentifying problem
 - Industry “buy-in” re solution because everyone had input, everyone’s interests considered
 - Prompt and willing implementation
 - Solution probably more effective and efficient
 - Unintended consequences much less likely



Challenges of Collaboration

- Requires all to be willing, in their enlightened self-interest, to leave their “comfort zone” and think of the System
- Not a democracy
 - Regulator must regulate
- Regulator probably not welcome
- Labor/Management issues between some participants
- Participants are potential co-defendants



Applicability of “System” Success:

- **Entire Industry**
- **Company (Some or All)**
- **Type of Activity**
- **Facility**
- **Team**



Manufacturer “System Think” Success

Aircraft Manufacturers are Increasingly Seeking Input, Throughout the Design Process, From

- ***Pilots*** (**User Friendly**)
- ***Mechanics*** (**Maintenance Friendly**)
- ***Air Traffic Services*** (**System Friendly**)



Failure: Inadequate “System Think”

- 1995 – Cali, Colombia
- Risk Factors
 - *Night*
 - *Airport in Deep Valley*
 - *No Ground Radar*
 - *Airborne Terrain Alerting Limited to “Look-Down”*
 - *Last Minute Change in Approach*
 - *More rapid descent (throttles idle, spoilers)*
 - *Hurried reprogramming*
- Navigation Radio Ambiguity
- Spoilers Do Not Retract With Power



Recommended Remedies Include:

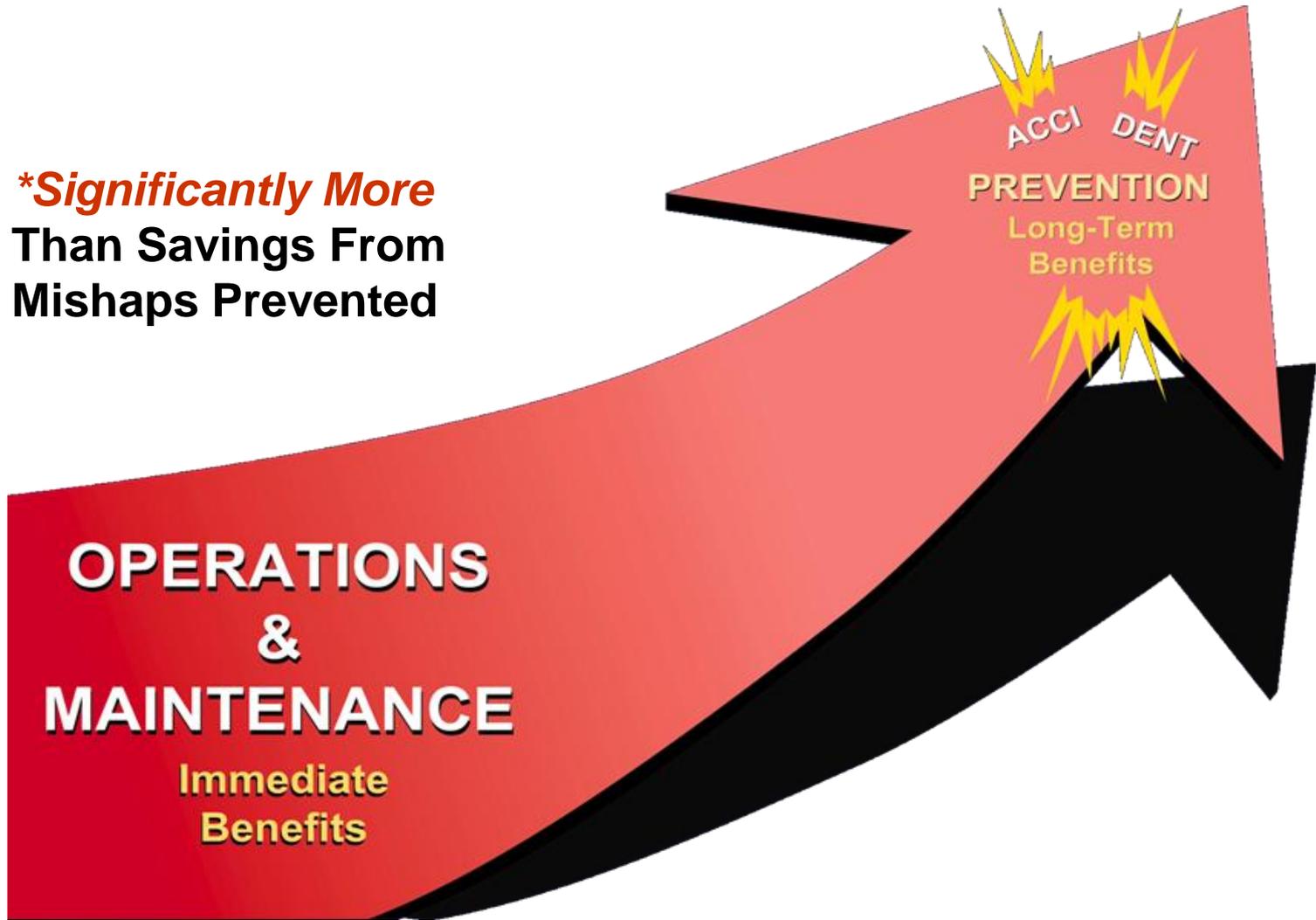
- **Operational**
 - *Caution Re Last Minute Changes to the Approach*
- **Aircraft/Avionics**
 - **Enhanced Ground Proximity Warning System**
 - **Spoilers That Retract With Max Power**
 - **Require Confirmation of Non-Obvious Changes**
 - **Unused or Passed Waypoints Remain In View**
- **Infrastructure**
 - **Three-Letter Navigational Radio Identifiers**
 - **Ground-Based Radar**
 - **Improved Reporting of, and Acting Upon, Safety Issues**

Note: All but one of these eight remedies address system issues



Major Benefit: Savings*

****Significantly More***
Than Savings From
Mishaps Prevented



Not Only Improved Safety, But Improved Productivity, Too

- **Ground Proximity Warning System**

- **S: *Reduced warning system complacency***
- **P: *Reduced unnecessary missed approaches, saved workload, time, and fuel***

- **Flap Overspeed**

- **S: *No more potentially compromised airplanes***
- **P: *Significantly reduced need to take airplanes off line for **VERY EXPENSIVE (!!) disassembly, inspection, repair, and reassembly*****



But Then . . .

Why Are We

So Jaded in The Belief That

Improving Safety

Will Probably

Hurt The Bottom Line??



Costly Result\$ Of Safety Improvements Poorly Done

Safety *Poorly* Done

1. Punish/re-train operator
 - *Poor workforce morale*
 - *Poor labor-management relations*
 - *Labor reluctant to tell management what's wrong*
 - *Retraining/learning curve of new employee if "perpetrator" moved/fired*
 - *Adverse impacts of equipment design ignored, problem may recur because manufacturers are not involved in improvement process*
 - *Adverse impacts of procedures ignored, problem may recur because procedure originators (management and/or regulator) are not involved in improvement process*

Safety *Well* Done

Look beyond operator,
also consider system
issues

Costly Result\$ Of Safety Poorly Done (con't)

Safety *Poorly* Done

2. Management decides remedies unilaterally

- *Problem may not be fixed*
- *Remedy may not be most effective, may generate other problems*
- *Remedy may not be most cost effective, may reduce productivity*
- *Reluctance to develop/implement remedies due to past remedy failures*
- *Remedies less likely to address multiple problems*

3. Remedies based upon instinct, gut feeling

- *Same costly results as No. 2, above*

Safety *Well* Done

Apply “System Think,” *with workers*, to identify and solve problems

Remedies based upon evidence (including info from front-line workers)



Costly Result\$ Of Safety Poorly Done (con't)

Safety *Poorly* Done

4. Implementation is
last step

- *No measure of how well remedy worked (until next mishap)*
- *No measure of unintended consequences (until something else goes wrong)*

Safety *Well* Done

Evaluation after
implementation

Conclusion: Is Safety Good Business?

- *Safety implemented poorly can be **very costly (and ineffective)***
- *Safety implemented well, in addition to improving safety more effectively, can also **create benefits greater than the costs***

The Role of Leadership

- Demonstrate Safety Commitment . . .
But Acknowledge That Mistakes Will Happen
- Include “Us” (e.g., System) Issues,
Not Just “You” (e.g., Training) Issues
- **Make Safety a Middle Management Metric**
- Engage Labor Early
- Include the *System* --
Manufacturers, Operators, Regulator(s), and
Others
- Encourage and Facilitate Reporting
- Provide *Feedback*
- Provide Adequate *Resources*
- *Follow Through* With Action



How The Regulator Can Help

- Emphasize importance of System issues *in addition to* (not instead of) worker issues
- Encourage and participate in industry-wide “System Think”
- Facilitate collection and analysis of information
 - Clarify and announce *policies for protecting information and those who provide it*
 - Encourage other industry participants to do the same
- Recognize that *compliance* is very important, but the *mission is reducing systemic risk*



Thank You!!!



Questions?

